PA Consulting Group

Plug-Load Energy-Efficiency on Campus

Advanced Design and Technologies for Higher Education Facilities Workshop
Lansing, Michigan
September 23, 2005

Presented by: Carol Sabo, PA Government Services, Inc.

Topics

Background and Sources of Information

Plug-Load Equipment Electric Usage

Opportunities to Reduce Plug-Load Electric Usage

Software and Hardware Tools

Other Resources/Strategies

Questions

Background and Sources of Data

Information Sources

NYSERDA's **New York Energy $mart[SM]** Offices Project:

- Carol Sabo, Lead Contractor Project Manager , PA Government Services, Inc. (carol.sabo@paconsulting.com) 703-915-4034
- Susan Andrews, NYSERDA Project Manager
- Katherine Johnson, Project Site Coordinator, KJ Consulting
- Tom Bolioli, IT Consultant, EPA Monitor Power Management (MPM)

EPA ENERGY STAR Monitor Power Management Program—Steve Ryan, Dave Korn, The Cadmus Group, EPA MPM Contractor

Lawrence Berkeley National Laboratory Plug-Load Program Research—Jeff Harris, Bruce Nordman

U.S. DOE Energy Consumption by Office and Telecommunications Equipment in Commercial Buildings Study—Dr. James Broderick

New York Energy $mart[SM] Offices

Funded through NYSERDA's **New York Energy $mart[SM]** program designed to lower electricity costs by encouraging energy-efficiency in the state

The goal of the project is to assess and help implement energy-savings potential from low-cost/no-cost measures targeting business and non-business plug-load equipment

NYSERDA funds the data collection and analysis, technical support, and outreach and education at no cost to project participants—government offices, municipal school districts, state universities and colleges

NYSERDA Project Services: Data Collection

Facilities and other staff provide building data:
campus maps, building use, square footage, equipment quantities and key locations (vending machines, laundry), electric data, building occupants (staff, faculty, students, residents), hours of operation, dorm policies for plug-load equipment

IT staff provide information system network data:
business equipment models and configurations, power management settings, key locations and use (computer labs, common area printers, copiers), update policies

Project team conducts on-site equipment surveys
to determine "power status," equipment usage, and non-inventoried plug-load equipment quantities

NYSERDA Project Services: Analysis/Facilitation

Project team **estimates total plug-load electric** usage for administrative, faculty, and students

Project team **identifies low-cost/no-cost measures** and estimate total potential plug-load savings opportunities

IT expert **discusses monitor power management options** with IT staff

Project team **discusses approaches to modify staff, student, and faculty behavior** to maximize plug-load energy-efficiency savings

Project team **provides support** to initiate procurement and other energy-efficiency policies

New York Energy $mart^{SM} Offices Projects

State University of New York (SUNY):

SUNY Albany

Alfred State University

SUNY Binghamton

University at Buffalo

Buffalo State

Cobleskill

SUNY Fredonia

Ithaca College

SUNY Oneonta

Community Colleges: Finger Lakes CC, Jefferson CC, Genesee CC, Tompkins CC

New York Energy $mart[SM] Offices Projects

Ithaca Area Community Based Regional Project:

Ithaca College

City of Ithaca

Tompkins County Community College

Tompkins County

Lehman Alternative Community School

Genesee Area Community Based Regional Project:

Genesee Community College

Genesee County

City of Batavia

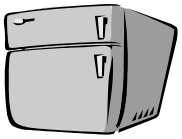
City of Batavia School District

Plug-Load Electric Usage

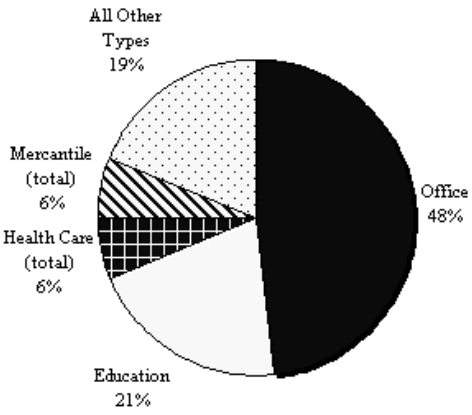
Total Plug-Load Equipment Usually Accounts for More Than 20 Percent of the Electric Use in Offices and 900 kWh or $72 per Office Employee Annually

- Computers & monitors
- Fax machines
- Printers
- Copiers
- Scanners and multi-function devices
- Small power supplies
- Speakers

- Vending machines
- Task lighting
- Coffee machines
- Water coolers
- Large refrigerators
- Space heaters



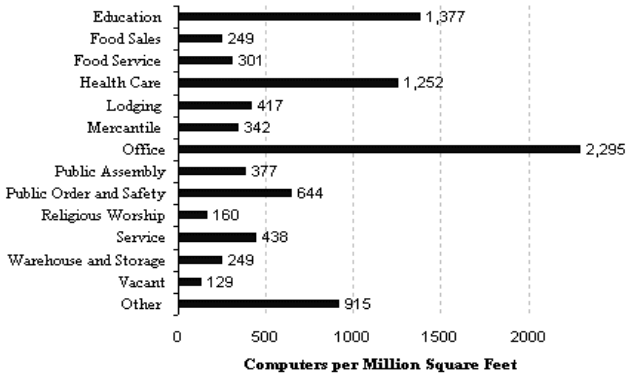
Distribution of Computers in Commercial Buildings, 1999



Source: Energy Information Administration, 1999 Commercial Buildings Energy Consumption Survey.

"The highest growth rates are expected for end uses that have not yet saturated the commercial market. Energy use for personal computers is projected to grow by 4.5 percent per year and for other office equipment, such as copiers, fax machines, and larger computers, by 4.8 percent per year through 2025." DOE EIA Annual Energy Outlook 2005 Report

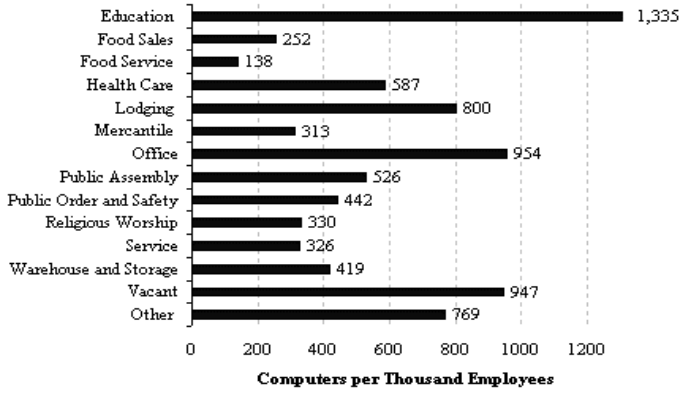
Ratio of Computers to Square Footage for Different Building Types



Source: Energy Information Administration, 1999 Commercial Buildings Energy Consumption Survey.

Offices are the most computer-intensive followed by Educational Facilities.

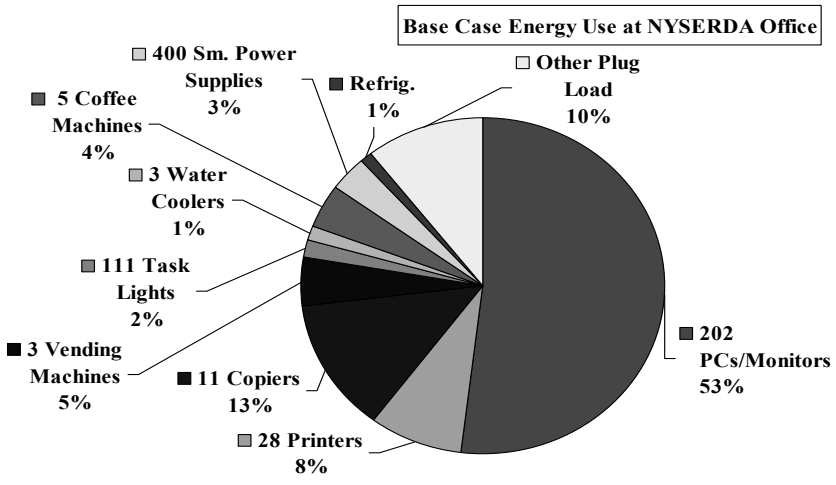
Ratio of Computers to Employees for Different Building Types



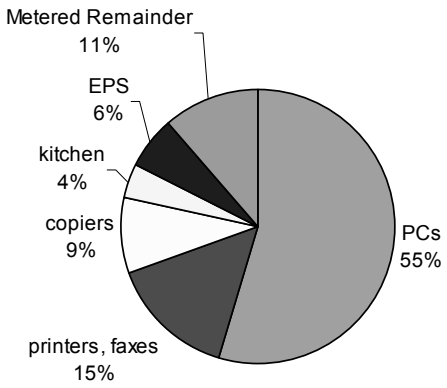
Source: Energy Information Administration, 1999 Commercial Buildings Energy Consumption Survey.

Education buildings, had, on average, more than one computer per employee (1.3 computers per employee), probably due to computers for student use.

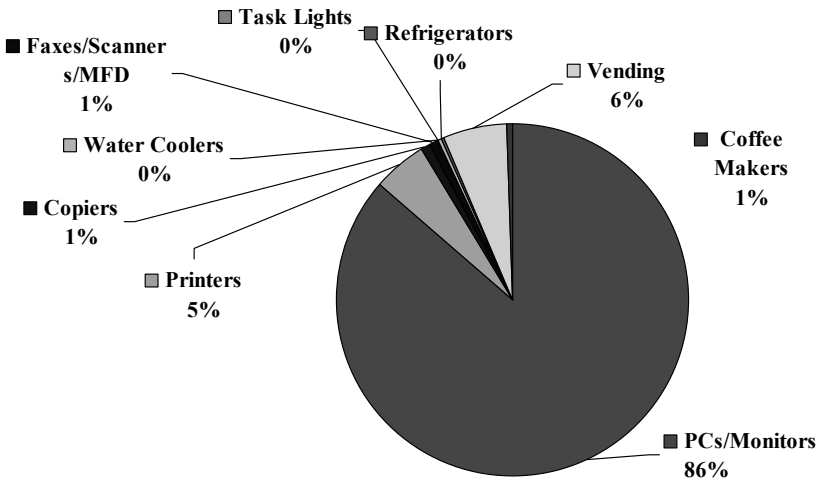
PCs Account for the Majority (53%) of Estimated Plug Load in the NYSERDA Albany Office of 200 Staff



PCs Account for the Majority (55%) of Estimated Plug Load at University at Buffalo in the Main Administrative Building



PCs Account for the Majority (86%) of Estimated Plug Load for a NYS Campus



Opportunities to Reduce Plug-Load Electric Usage

Three "P's" of LOW COST/NO COST Plug-Load Efficiency Measures

Purchase ENERGY STAR® equipment: develop and enforce purchasing/leasing standards that specify ENERGY STAR® equipment including vending machines.

Power manage: ensure that all ENERGY STAR® office equipment (computers, printers, copiers) are enabled to go into "low power" or "sleep mode" when not in use.

Power off: encourage staff and students to turn off computers, printers, and other plug-load equipment when not being used.

Personal Computers & Monitors

Implement monitor power management (MPM) and computer power management (when possible)—set power saving features for equipment to go into low-power or "sleep mode" when not in active use for 20 minutes or less

Power off computer boxes, monitors, and speakers at the end of the day

Average savings per PC for monitor power management (MPM) and shutdown varies for staff and student behavior: $14-$50 per PC (could be higher with computer power management)

Student PC Savings Estimates

For desktop personal computers (PCs) that are on 24/7 each day, an estimated average cost savings of $48 each (at 7 cents per kWh) is possible for monitor power management (MPM) plus shutoff of PC boxes and monitors when not in use

For a group of personal computers, the estimated total annual cost savings at $48 per unit are:

- 60 PCs: $2,880
- 6000 PCs: $288,000 annually

The estimated potential average cost savings drops to $14 per PC for MPM + shutdown if personal computers are typically left on 12 hours per day

Personal Computers and Monitors

Limit the use of 3-dimensional screen savers—they can double the power use of some PCs—use black screen savers in conjunction with monitor power management

Consider ordering LCD monitors that use 40-60 watts less power than equivalent CRT monitors—including non-energy benefits such as reduced heat may justify the incremental cost of specifying LCDs for new monitor purchases

Using laptops instead of desktop computers may cut the computer electric use by 50 percent or more

Vending Machines

Replace cold beverage vending machines with units that meet ENERGY STAR® Tier II Specifications

Remove vending machine lights or use occupancy sensors

Assess electric costs versus revenues for vending machines

Estimated annual electric cost savings for each machine based on replacement: $116 to $220 per unit

Copiers/ Document Centers

Replace copiers with new equipment that meet ENERGY STAR® specifications and ensure they are enabled for maximum savings

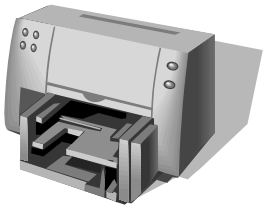
ENERGY STAR ® copiers are enabled to go into low power mode after 15 minutes of inactivity and “auto off” after 90 minutes (or less) of inactivity

Estimated annual electric cost savings for copiers: $50-$240

Printers

Set all printers to go into “power saver” mode after 15 minutes of inactivity

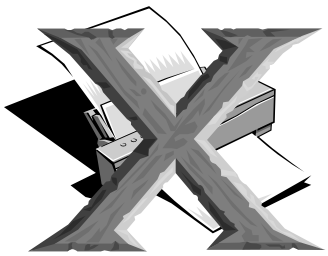
Power off all printers (large and small) when staff or students leave for the day



Total annual savings range from $5 to $27 depending on size of printer, staff behavior, and cost per kWh.

Small Printers

Consider consolidating small individual printers used by staff with large common area printers



There may be a small electric saving from eliminating the small printers if that change facilitates equipment power management and shut down

BUT The operating and maintenance costs savings from ink cartridges and IT support can be significant at $100 per printer

Other Business Equipment

Ensure faxes, scanners, and multifunction devices all meet ENERGY STAR® specifications and are set to go into "power saver" mode when not in use

Power down equipment after hours (when possible) or when not in use

Directives from "up high" do work

Estimated annual electric cost savings per units: $6-$12 per unit

Water Coolers

Turn off hot water taps on hot/cold units

Use timers to turn off after hours

Purchase ENERGY STAR® qualifying equipment when replacing old units

Estimated annual electric cost savings: $35-$106 per unit

Appliances

Replace very old, inefficient refrigerators with new efficient units

Turn off at night or use timers for the large coffee makers that continuously heat water

Estimated annual electric cost savings:

- refrigerator: $35 or more
- large coffee maker: $24-35

Miscellaneous Office Space Equipment

Miscellaneous plug-load equipment can add 10 percent or more to your administrative office plug-load electric costs. Make it a policy for staff to turn off all equipment in their office when not in use to cut electric costs:

- Small Coffee Pots
- Fans/Space Heaters
- Computer Speakers
- Small Power Supplies
- Radios/Task Lights
- Typewriters/Adding Machines/Calculators

Comparison of Potential Savings Estimates for University Projects

University and Source of Project Information	Measures	# PCs/ Staff/ Students	Potential Annual Savings	Estimated Annual Savings per Unit
UB Campus-wide Staff & Students (NYSERDA)	MPM & PC Shutdown Only	20,000	$280,000	$14 per PC
Univ. at Buffalo (UB) Student "Do in the Dark" Campaign (NYSERDA)	MPM & PC Shutdown Only	7,000 7,000	$100,000 $330,000	$14 per PC on 12 hrs. $48 per PC on 24 hrs.
Univ. at Buffalo (UB) Vending Machines (NYSERDA)	Install New ENERGY STAR Vending Machines	77 Vending Machines	$9,000	$116 per machine
Harvard Computer Energy Reduction Program (EPA ENERGY STAR)	Monitor Power Management (MPM)	800	$14,000	$17.50 per PC
Penn State Physical Plant Office (EPA ENERGY STAR)	Monitor Power Management (MPM)	268	$17,000	$63 per PC
Tulane University Student "Sleep is Good" (EPA ENERGY STAR)	Monitor Power Management (MPM)	6,000	$78,000	$13 per PC

Software and Hardware Tools

Monitor and Computer Power Management Tools

What is Power Management?

Monitor power management (MPM) places active ***monitors*** into a low power sleep mode after sitting idle for a specified period

- Reduces power draw from 60–90 watts to 2–3 watts

Computer power management (CPM) places the ***computer*** itself (CPU, hard drive, etc.) into a low power sleep mode

- Reduces power draw from 40–90 watts to 2-3 watts

Monitor and Computer Power Management Tools

Why Power Manage?

More than half of electricity used to power PCs is wasted

- 60% of monitors are left on at night
- 30% to 45% are not enabled for MPM
- 90+% are not enabled for CPM

PM Capability Already Exists in Windows 95,98, ME, 2000 and XP—Needs to be Activate

WINDOWS OPERATING SYSTEM'S POWER MANAGEMENT OPTION AVAILABILITY Source: EPA ENERGY STAR Power Management						
	95	98	NT	ME	2000	XP
Monitor Power Management						
Turn Off Monitor	Y	Y	N	Y	Y	Y
Monitor Standby	Y	N	N	N	N	N
Computer Power Management						
Turn off Hard Drives	Y	Y	N	Y	Y	Y
System Standby	N	Y	N	Y	Y	Y
System Hibernate	N	N	N	Y	Y	Y

Monitor and Computer Power Management Tools

ENERGY STAR (free download: www.energystar.gov/powermanagement)

- ***EZ Wizard*** **is a simple software tool that automatically activates MPM settings on individual PCs. Because it can be launched from a website, EZ Wizard is an ideal solution for individual computer users in diverse computing environments like colleges and universities.**
- ***EZ Save*** **is a free, centrally administered software tool that allows you to activate MPM features on an entire network of computers simultaneously. In addition, its polling feature allows you to determine the current status of MPM features on PCs in your network.**
- ***EZ GPO*** **allows a network administrator to centrally control computer power management and monitor power management settings using Group Policy Objects.**

1e ($8/seat)

- *NightWatchman* remotely turns computers on and off (S5); requires Wake on Lan to already be enabled (www.1e.com)

DesktopStandard ($10/seat)

- Among 100's of non PM features, *Policy Maker Pro* recreates the user applet for power management in GP. Also implements settings for client machines when in a logged off state (www.desktopstandard.com)

Verdiem (~$15/seat)

- *Surveyor* manages client machine's logged on and off PM features and implements time based power profiles (www.verdiem.com)

Vending Machine Tools and Options

Options to reduce electric use of cold beverage machines:

- **Remove lights** from vending machines—may reduce revenues if students think the machine is out of service
- Turn lights off by a schedule **using timer circuits or time clocks**—need to educate staff and students
- **Install occupancy type sensors** to reduce lighting and compressor energy use (e.g., Vending Miser)—need to understand technical issues and costs. www.bayviewtech.com/energy/vendingmiser_overview.php
- **Specify more energy efficient vending machines** for replacement—see the following site for information on leasing vending machines: www.eere.energy.gov/femp/pdfs/beverage_vending_machines.pdf

Other Resources/Strategies

University Strategies for Plug-Load Efficiency

Work with students to build awareness of and to promote monitor power management

Develop research projects using student interns to conduct plug-load equipment surveys on campus including spot metering to determine power usage of various computers and monitors in different power states and with different screen savers

Encourage interested faculty to develop curriculums or clubs that promote plug-load efficiency projects

http://www.buffalo.edu/inthedark/index.html

University Strategies for Plug-Load Efficiency

Work with computer lab staff to identify opportunities to shut down computer labs or blocks of computers in labs when not fully utilized (during session breaks and after hours) to save cooling an plug-load electric costs

Consider the economics of replacing CRTs with LCDs, particularly in small rooms that have a mass of computer equipment to save cooling and plug-load electric costs

Review other opportunities to save energy during session breaks including unplugging empty refrigerators and shutting off water heaters that are dedicated to laundry facilities not in use for an extended break

Questions

More Information

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